

SEQUENCE LISTING



SAC H3
<110> Lo, Reggie Y.C.
Schryvers, Anthony B.
Potter, Andrew A.

<120> TRANSFERRIN BINDING PROTEINS OF
PASTEURELLA HAEMOLYTICA AND VACCINES CONTAINING SAME

<130> 021645.0105

<140> 08/753,750
<141> 1996-11-29

<150> US 60/008,569
<151> 1995-12-01

<150> CA 2,164,274
<151> 1995-12-01

<160> 52

<170> FastSEQ for Windows Version 4.0

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<212> DNA
<213> Pasteurella haemolytica

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62

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<212> PRT
<213> Pasteurella haemolytica

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35 40 45
Thr Glu Ser His Tyr Ala His Glu Arg Gln Asn Glu Val Thr Gly Leu
50 55 60
Gly Lys Val Val Lys Asn Tyr His Glu Met Ser Lys Asn Gln Ile Leu
65 70 75 80
Gly Ile Arg Asp Leu Thr Arg Tyr Asp Pro Gly Ile Ser Val Val Glu
85 90 95
Gln Gly Arg Gly Ala Ser Ser Gly Tyr Ala Ile Arg Gly Val Asp Lys
100 105 110
Asn Arg Val Ser Leu Leu Val Asp Gly Leu Pro Gln Ala His Ser Tyr
115 120 125
His Thr Leu Gly Ser Asp Ala Asn Gly Gly Ala Ile Asn Glu Ile Glu
130 135 140
Tyr Glu Asn Ile Arg Ser Ile Glu Leu Ser Lys Gly Ala Ser Ser Ala
145 150 155 160

83

Glu Tyr Gly Ser Gly Ala His Gly Gly Ala Ile Gly Phe Arg Thr Lys
165 170 175
Asp Ala Gln Asp Ile Ile Lys Glu Gly Gln His Trp Gly Leu Asp Ser
180 185 190
Lys Thr Ser Tyr Ala Ser Lys Asn Ser His Phe Leu Gln Ser Ile Ala
195 200 205
Ala Ala Gly Glu Ala Gly Gly Phe Glu Ala Leu Val Ile Ala Thr His
210 215 220
Arg His Gly Lys Glu Thr Lys Ile His Ser Glu Ala Asn Lys Leu Lys
225 230 235 240
His Asn Ile Arg Arg Ile Thr Gly Phe Glu Asn Arg Tyr Asp Phe Thr
245 250 255
Gln Ile Pro His Arg Met Leu Leu Glu Asp Leu Leu Ile Val Glu
260 265 270
Asp Thr Cys Pro Thr Leu Asp Cys Thr Pro Arg Ala Arg Val Lys Leu
275 280 285
Asn Arg Asp Asn Phe Pro Val Arg Thr Phe Pro Glu Tyr Thr Pro Glu
290 295 300
Glu Arg Lys Gln Leu Glu Gln Ile Pro Tyr Arg Thr Glu Gln Leu Ser
305 310 315 320
Ala Gln Glu Tyr Thr Gly Lys Asp Arg Ile Ala Pro Asn Pro Leu Asp
325 330 335
Tyr Lys Ser Asn Ser Val Phe Met Lys Phe Gly Tyr His Phe Asn Ser
340 345 350
Ser His Tyr Leu Gly Ala Ile Leu Glu Asp Thr Lys Thr Arg Tyr Asp
355 360 365
Ile Arg Asp Met Gln Thr Pro Ala Tyr Tyr Thr Lys Asp Asp Ile Asn
370 375 380
Leu Ser Leu Arg Asn Tyr Val Tyr Glu Gly Asp Asn Ile Leu Asp Gly
385 390 395 400
Leu Val Phe Lys Pro Arg Ile Pro Tyr Gly Leu Arg Tyr Ser His Val
405 410 415
Lys Phe Phe Asp Glu Arg His His Lys Arg Arg Leu Gly Phe Thr Tyr
420 425 430
Lys Tyr Lys Pro Glu Asn Asn Arg Trp Leu Asp Ser Ile Lys Leu Ser
435 440 445
Ala Asp Lys Gln Asp Ile Glu Leu Tyr Ser Arg Leu His Arg Leu His
450 455 460
Cys Ser Asp Tyr Pro Val Val Asp Lys Asn Cys Arg Pro Thr Leu Asp
465 470 475 480
Lys Ser Trp Ser Met Tyr Arg Thr Glu Arg Asn Asn Tyr Gln Glu Lys
485 490 495
His Arg Val Ile His Leu Glu Phe Asp Lys Ala Leu Asn Ala Gly Gln
500 505 510
Gly Val Phe Asn Gln Thr His Lys Leu Asn Leu Gly Leu Gly Phe Asp
515 520 525
Arg Phe Asn Ser Leu Met Asp His Gly Asp Met Thr Ala Gln Tyr Thr
530 535 540
Lys Gly Gly Tyr Thr Ser Tyr Arg Gly Arg Gly Arg Leu Asp Asn Pro
545 550 555 560
Tyr Ile Tyr Arg Arg Asp Pro Arg Ser Ile Glu Thr Val Ser Leu Cys
565 570 575
Asn Asn Thr Arg Gly Asp Ile Leu Asn Cys Glu Pro Arg Lys Ile Lys

84

580 585 590
Gly Asp Ser His Phe Val Ser Phe Arg Asp Leu Val Ile Ser Glu Tyr
595 600 605
Val Asp Leu Gly Leu Gly Val Arg Phe Asp Gln His Arg Phe Lys Ser
610 615 620
Asp Asp Pro Trp Thr Leu Ser Arg Thr Tyr Arg Asn Trp Ser Trp Asn
625 630 635 640
Gly Gly Ile Thr Leu Lys Pro Thr Glu Phe Val Ser Leu Ser Tyr Arg
645 650 655
Ile Ser Asn Gly Phe Arg Val Pro Ala Phe Tyr Glu Leu Tyr Gly Lys
660 665 670
Arg Asp His Ile Gly Leu Lys Asp Asn Glu Tyr Val Gln Arg Ala Gln
675 680 685
Arg Ser His Gln Leu Glu Pro Glu Lys Ser Thr Asn His Glu Ile Gly
690 695 700
Val Ser Phe Lys Gly Gln Phe Gly Tyr Leu Asp Val Ser Tyr Phe Arg
705 710 715 720
Asn Asn Tyr Lys Asn Met Ile Ala Thr Ala Cys Lys Arg Ile Ile Gln
725 730 735
Lys Ser His Cys Phe Tyr Asn Tyr His Asn Ile Gln Asp Val Ala Leu
740 745 750
Asn Gly Ile Asn Leu Val Ala Lys Phe Asp Leu His Gly Ile Leu Ser
755 760 765
Met Leu Pro Asp Gly Phe Tyr Ser Ser Val Ala Tyr Asn Arg Val Lys
770 775 780
Val Lys Glu Arg Lys Leu Thr Asp Ser Arg Leu Asp Ser Val Asn Asp
785 790 795 800
Pro Ile Leu Asp Ala Ile Gln Pro Ala Arg Tyr Val Leu Gly Phe Gly
805 810 815
Tyr Asp His Pro Glu Glu Lys Trp Gly Ile Gly Ile Thr Thr Thr Tyr
820 825 830
Ser Lys Ala Lys Asn Ala Asp Glu Val Ala Gly Thr Arg His His Gly
835 840 845
Ile His Arg Val Asp Leu Gly Gly Lys Leu Thr Gly Ser Trp Tyr Thr
850 855 860
His Asp Ile Thr Gly Tyr Ile Asn Tyr Lys Asn Tyr Thr Leu Arg Gly
865 870 875 880
Gly Ile Tyr Asn Val Thr Asn Arg Lys Tyr Ser Thr Trp Glu Ser Val
885 890 895
Arg Gln Ser Gly Val Asn Ala Val Asn Gln Asp Arg Gly Ser Asn Tyr
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<212> DNA
<213> Pasteurella haemolytica

<400> 3

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gaaactgaag ctttattgca gcccgggtt ggttttcag cccaaattcc gcgtcgtaat 240
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<212> PRT
<213> Pasteurella haemolytica

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35 40 45
Asp Asn Ser Asn Ala Arg Arg Thr Val Ser Ala Ser Glu Thr Glu Ala
50 55 60
Leu Leu Gln Pro Gly Phe Gly Phe Ser Ala Lys Ile Pro Arg Arg Asn
65 70 75 80
Leu Leu Pro Gln Gly Lys Glu Asp Val Ala Pro Ile Gly Asp Ile Lys
85 90 95
Glu Ile Thr Gly Asp Leu Pro Lys Ile Pro Tyr Glu Glu Val Lys
100 105 110
Ala Cys Gly Ser Ser Ala Asp Gly Phe Ser His Thr His Asp Arg Asn
115 120 125

86

His Lys Leu Tyr Thr Arg Asp Phe Asn Phe Val Arg Ser Gly Tyr Val
130 135 140
Val His Ser Gly Pro Lys Pro Glu Ile Lys Pro Lys Glu Ile Leu Arg
145 150 155 160
Thr Gly Ala His Gly Tyr Val Tyr Tyr Leu Gly Ile Glu Pro Pro Lys
165 170 175
Ala Ile Pro Thr Gln Lys Leu Thr Tyr Lys Gly Tyr Trp Asp Phe Thr
180 185 190
Thr Tyr Ala Ala Lys Gly Arg Asp Ser Asn Ile Phe Leu Ile Pro Ala
195 200 205
Gly Ile Asn Ser Gly Ala Ile Pro Glu Asn Ser His Asp Ile Asn Val
210 215 220
Asp Asp Ser Glu Lys Pro Met Gly His Thr Gly Glu Phe Thr Ala Asp
225 230 235 240
Phe Ala Asn Lys Thr Leu Thr Gly Thr Leu Val Arg Asn Gly Tyr Val
245 250 255
Ser Arg Ser Lys Glu Gln Lys Ile Thr Thr Ile Tyr Asp Ile Asp Ala
260 265 270
Lys Ile Lys Gly Asn Arg Phe Ser Gly Lys Ala Asn Pro Lys Lys Pro
275 280 285
Met Ile Leu Ile Phe Gly Lys Ser Ser Thr Thr Leu Glu Gly Gly Phe
290 295 300
Phe Gly Gly Glu Ala Gln Glu Leu Ala Gly Lys Phe Leu Ala Asp Asp
305 310 315 320
Lys Ser Val Phe Val Val Phe Ala Gly Thr Arg Asp Ala Lys Lys Asp
325 330 335
Asp Ser Glu Ser Ala Phe Asp Ala Phe Pro Ile Lys Leu Lys Asp Leu
340 345 350
Asn Lys Ser Glu Met Asp Thr Phe Gly Asn Ala Thr His Leu Ile Ile
355 360 365
Asn Asn Lys Gln Ile Pro Leu Ile Ala Glu Ala Thr Lys Ser Phe Ala
370 375 380
Glu Met Lys Phe Asp Asp Leu Val Thr Arg Thr Ile Asp Gly Lys Thr
385 390 395 400
Tyr Arg Val Ser Val Cys Cys Asn Asn Leu Asp Tyr Val Lys Phe Gly
405 410 415
Ile Tyr Ser Glu Gly Asn Asn Ser Asp Thr Ala Leu Gln Glu Tyr Leu
420 425 430
Val Gly Glu Arg Thr Ala Leu Ala Asp Leu Pro Thr Gly Thr Val Lys
435 440 445
Tyr Arg Gly Thr Trp Asp Gly Val Met Tyr Ser Lys Ser Gly Ser Ala
450 455 460
Gly Val Glu Ser Pro Ser Asn Ser Glu Ser Gly Thr Arg Ser Leu Phe
465 470 475 480
Asp Val Asp Phe Val Asn Lys Lys Ile Asn Gly Lys Leu Ile Ala Asn
485 490 495
Asp Gly Val Glu Glu Arg Pro Met Leu Thr Leu Glu Gly Asn Leu Lys
500 505 510
Gly Asn Gly Phe Gly Gly Thr Ala Lys Thr Gly Asn Ser Gly Phe Asn
515 520 525
Leu Asp Pro Lys Ser Thr Asn Gly Gly Thr Val Gly His Ile Asn Thr
530 535 540
Gln Phe Glu Gly Gly Phe Tyr Gly Pro Lys Ala Thr Glu Leu Gly Gly

89

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<213> Pasteurella haemolytica

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aataa 2045

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<211> 3023
<212> DNA
<213> Pasteurella haemolytica

88

<400> 6

89

<210> 7
<211> 65
<212> DNA
<213> Pasteurella haemolytica

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<210> 8
<211> 59
<212> DNA
<213> Pasteurella haemolytica

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<210> 9
<211> 72
<212> DNA
<213> Pasteurella haemolytica

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agggttata tg 72

<210> 10
<211> 898
<212> PRT
<213> Pasteurella haemolytica

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35 40 45
Thr Glu Ser His Tyr Ala His Glu Arg Gln Asn Glu Val Thr Gly Leu
50 55 60
Gly Lys Val Val Lys Asn Tyr His Glu Met Ser Lys Asn Gln Ile Leu
65 70 75 80
Gly Ile Arg Asp Leu Thr Arg Tyr Asp Pro Gly Ile Ser Val Val Glu
85 90 95
Gln Gly Arg Gly Ala Ser Ser Gly Tyr Ala Ile Arg Gly Val Asp Lys
100 105 110
Asn Arg Val Ser Leu Leu Val Asp Gly Leu Pro Gln Ala His Ser Tyr
115 120 125
His Thr Leu Ser Gly Asp Ala Asn Gly Gly Ala Ile Asn Glu Ile Glu
130 135 140
Tyr Glu Asn Ile Arg Ser Ile Glu Leu Ser Lys Gly Ala Ser Ser Ala
145 150 155 160

90

Glu Tyr Gly Ser Gly Ala His Gly Gly Ala Ile Gly Phe Arg Thr Lys
165 170 175
Asp Ala Gln Asp Ile Ile Lys Glu Gly Gln His Trp Gly Leu Asp Ser
180 185 190
Lys Thr Ser Tyr Ala Ser Lys Asn Ser His Phe Leu Gln Ile Ala Ala
195 200 205
Ala Gly Glu Ala Gly Gly Phe Glu Ala Leu Val Ile Ala Thr His Arg
210 215 220
His Gly Lys Glu Thr Lys Ile His Ser Glu Ala Asn Lys Leu Lys His
225 230 235 240
Asn Ile Arg Arg Ile Thr Gly Phe Glu Asn Arg Tyr Asp Phe Thr Gln
245 250 255
Ile Pro His Arg Met Pro Pro Gly Gly Ser Phe Phe Ile Val Glu Asp
260 265 270
Thr Cys Pro Thr Leu Asp Cys Thr Pro Arg Ala Arg Val Lys Leu Asn
275 280 285
Arg Asp Asn Phe Pro Val Arg Thr Phe Pro Glu Tyr Thr Pro Glu Glu
290 295 300
Arg Asn Ala Glu Gln Ile Pro Tyr Arg Thr Glu Gln Leu Ser Ala Gln
305 310 315 320
Glu Lys Thr Gly Lys Asp Arg Ile Ala Pro Asn Pro Leu Asp Tyr Lys
325 330 335
Ser Asn Ser Val Phe Met Lys Phe Gly Tyr His Phe Asn Ser Ser His
340 345 350
Tyr Leu Gly Ala Ile Leu Glu Asp Thr Lys Gln Arg Thr Ile Ser Val
355 360 365
Ile Cys Lys Arg Gln Leu Thr Ile Gln Lys Thr Ile Leu Thr Tyr His
370 375 380
Leu Gly Thr Met Phe Met Lys Gly Ile Ile Phe Arg Trp Leu Ser Val
385 390 395 400
Gln Ala Lys Asp Pro Leu Trp Val Ala His Met Pro Cys Glu Val Asp
405 410 415
Glu Arg His His Lys Arg Arg Leu Gly Phe Thr Tyr Lys Tyr Lys Pro
420 425 430
Glu Asn Asn Arg Trp Leu Asp Ser Ile Asn Ser Cys Val Arg Ala Leu
435 440 445
Arg Ser Arg Cys Cys Ala Leu Ser Lys Gln Asp Ile Glu Leu Tyr Ser
450 455 460
Arg Leu His Arg Leu His Cys Ser Asp Tyr Pro Val Val Asp Lys Asn
465 470 475 480
Cys Gly Pro Thr Leu Asp Lys Ser Trp Ser Met Tyr Arg Thr Glu Arg
485 490 495
Asn Asn Tyr Gln Glu Lys His Arg Val Ile His Leu Glu Phe Asp Leu
500 505 510
Ala Leu Asn Ala Gly Gln Gly Val Phe Leu Gln Thr His Lys Leu Asn
515 520 525
Leu Gly Leu Gly Phe Glu Ser Ile Asn Ser Leu Met Asp His Gly Asp
530 535 540
Met Thr Ala Gln Tyr Thr Leu Gly Arg Leu Tyr Gln Leu Pro Arg Arg
545 550 555 560
Asp Pro Arg Ser Ile Trp Thr Val Ser Leu Cys Asn Asn Thr Arg Ala
565 570 575
Thr Leu Asn Cys Asp Ala Leu Asn Leu Gly Ile Arg Leu Tyr Leu Arg

580	585	590
Cys Cys Leu Ile Asn Gln Leu Asn Asn Pro Arg Tyr Gly Ser Val Leu		
595	600	605
Phe Gln Phe Gly Thr Arg Val His Arg Thr Trp Thr Pro Thr Ser Leu		
610	615	620
Gly Glu Leu Pro Ser Ile Arg Ala Met Ala His Tyr Val Asn His His		
625	630	635
Pro Asn Gln Val Phe Trp Gly Arg Gly Ala Val Lys His Leu Thr Leu		
645	650	655
Leu Ser Ser Pro Trp Met Leu Lys Phe Ala Ala Ser Gly Arg His Val		
660	665	670
Thr Leu Ser Val Ile Ser Gly Ala Thr Asp Arg Phe Leu Val Pro Pro		
675	680	685
Leu Ile Leu Thr Gly Val Asn Tyr Lys Asn Glu Ser Tyr Val Ser Ala		
690	695	700
Ile Tyr Asn Val Asp Val Arg Tyr Cys Lys Thr Leu Tyr Tyr Arg Gly		
705	710	715
Gln Gln Leu Gly Asp Arg Ala Thr Gly Gln Ala Lys Pro Asp Gly Tyr		
725	730	735
Gln Leu His Arg Phe Ala Ala Pro Gly Arg Asn Phe Ser Tyr His Ser		
740	745	750
Lys Lys Phe Arg Pro Ala Lys Glu Asn Thr Lys Asn Ala Glu Ser Ile		
755	760	765
Phe Ser Ala Phe Phe Val Gly Ser Asn Gly Leu His Thr Asn Ser Lys		
770	775	780
Ser Cys Phe Asn Gly Arg Leu His Glu Pro Ile Pro Tyr Phe Phe Asn		
785	790	795
Phe Leu Arg Asn Val Pro Arg Phe Asn Glu Tyr His Cys Cys Thr		
805	810	815
Ser Leu Ile Ala Ala Ser Ile Leu Leu His His Ile Tyr His Trp Val		
820	825	830
Phe Asp Phe Arg Tyr Tyr Phe Val Tyr Phe Cys Trp Ile Leu His		
835	840	845
His Leu Ile His Ile Asn Ser Phe Leu Met Leu Leu Ser His Tyr Arg		
850	855	860
Glu Val Val Tyr Leu Thr Cys Cys Ala Cys Ala Phe Asn Ile Val Thr		
865	870	875
Val Asn Gly Phe Cys Val Gly Cys Cys Ser Asn Ile Leu Ala Glu Met		
885	890	895
Lys Phe		

<210> 11
<211> 917
<212> PRT
<213> Pasteurella haemolytica

<400> 11
Met Gln Gln His Leu Phe Arg Leu Asn Ile Leu Cys Leu Ser Leu
1 5 10 15
Met Thr Ala Leu Pro Ala Tyr Ala Glu Asn Val Gln Ala Gly Gln Ala
20 25 30

gr

Gln Glu Lys Gln Leu Asp Thr Ile Gln Val Lys Ala Lys Lys Gln Lys
35 40 45
Thr Arg Arg Asp Asn Glu Val Thr Gly Leu Gly Lys Leu Val Lys Thr
50 55 60
Ala Asp Thr Leu Ser Lys Glu Gln Val Leu Asp Ile Arg Asp Leu Thr
65 70 75 80
Arg Tyr Asp Pro Gly Ile Ala Val Val Glu Gln Gly Arg Gly Ala Ser
85 90 95
Ser Gly Tyr Ser Ile Arg Gly Met Asp Lys Asn Arg Val Ser Leu Thr
100 105 110
Val Asp Gly Leu Ala Gln Ile Gln Ser Tyr Thr Ala Gln Ala Ala Leu
115 120 125
Gly Gly Thr Arg Thr Ala Gly Ser Ser Gly Ala Ile Asn Glu Ile Glu
130 135 140
Tyr Glu Asn Val Lys Ala Val Glu Ile Ser Lys Gly Ser Asn Ser Val
145 150 155 160
Glu Gln Gly Ser Gly Ala Leu Ala Gly Ser Val Ala Phe Gln Thr Lys
165 170 175
Thr Ala Asp Asp Val Ile Gly Glu Gly Arg Gln Trp Gly Ile Gln Ser
180 185 190
Lys Thr Ala Tyr Ser Gly Lys Asn Arg Gly Leu Thr Gln Ser Ile Ala
195 200 205
Leu Ala Gly Arg Ile Gly Gly Ala Glu Ala Leu Leu Ile Arg Thr Gly
210 215 220
Arg His Ala Gly Glu Ile Arg Ala His Glu Ala Ala Gly Arg Gly Val
225 230 235 240
Gln Ser Phe Asn Arg Leu Ala Pro Val Asp Asp Gly Ser Lys Tyr Ala
245 250 255
Tyr Phe Ile Val Glu Glu Cys Lys Asn Gly Gly His Glu Lys Cys
260 265 270
Lys Ala Asn Pro Lys Lys Asp Val Val Gly Glu Asp Lys Arg Gln Thr
275 280 285
Val Ser Thr Arg Asp Tyr Thr Gly Pro Asn Arg Phe Leu Ala Asp Pro
290 295 300
Leu Ser Tyr Glu Ser Arg Ser Trp Leu Phe Arg Pro Gly Phe Arg Phe
305 310 315 320
Glu Asn Lys Arg His Tyr Ile Gly Gly Ile Leu Glu Arg Thr Gln Gln
325 330 335
Thr Phe Asp Thr Arg Asp Met Thr Val Pro Ala Phe Leu Thr Lys Ala
340 345 350
Val Phe Asp Ala Asn Gln Lys Gln Ala Gly Ser Leu Arg Gly Asn Gly
355 360 365
Asn His Lys Tyr Ala Gly Asn His Lys Tyr Gly Gly Leu Phe Thr Ser
370 375 380
Gly Glu Asn Asn Ala Pro Val Gly Ala Glu Tyr Gly Thr Gly Val Phe
385 390 395 400
Tyr Asp Glu Thr His Thr Lys Ser Arg Tyr Gly Leu Glu Tyr Val Tyr
405 410 415
Thr Asn Ala Asp Lys Asp Thr Trp Ala Asp Tyr Ala Arg Leu Ser Tyr
420 425 430
Asp Arg Gln Gly Ile Gly Leu Asp Asn His Phe Gln Gln Thr His Cys
435 440 445
Ser Ala Asp Gly Ser Asp Lys Tyr Cys Arg Pro Ser Ala Asp Lys Pro

93

450 455 460
Phe Ser Tyr Tyr Lys Ser Asp Arg Val Ile Tyr Gly Glu Ser His Lys
465 470 475 480
Leu Leu Gln Ala Ala Phe Lys Lys Ser Phe Asp Thr Ala Lys Ile Arg
485 490 495
His Asn Leu Ser Val Asn Leu Gly Tyr Asp Arg Phe Gly Ser Asn Leu
500 505 510
Arg His Gln Asp Tyr Tyr Gln Ser Ala Asn Arg Ala Tyr Ser Leu
515 520 525
Lys Thr Pro Pro Gln Asn Asn Gly Lys Lys Thr Ser Pro Asn Gly Arg
530 535 540
Glu Lys Asn Pro Tyr Trp Val Ser Ile Gly Arg Gly Asn Val Val Thr
545 550 555 560
Arg Gln Ile Cys Leu Phe Gly Asn Asn Thr Tyr Thr Asp Cys Thr Pro
565 570 575
Arg Ser Ile Asn Gly Lys Ser Tyr Tyr Ala Ala Val Arg Asp Asn Val
580 585 590
Arg Leu Gly Arg Trp Ala Asp Val Gly Ala Gly Leu Arg Tyr Asp Tyr
595 600 605
Arg Ser Thr His Ser Asp Asp Gly Ser Val Ser Thr Gly Thr His Arg
610 615 620
Thr Leu Ser Trp Asn Ala Gly Ile Val Leu Lys Pro Ala Asp Trp Leu
625 630 635 640
Asp Leu Thr Tyr Arg Thr Ser Thr Gly Phe Arg Leu Pro Ser Phe Ala
645 650 655
Glu Met Tyr Gly Trp Arg Ser Gly Asp Lys Ile Lys Ala Val Lys Ile
660 665 670
Asp Pro Glu Lys Ser Phe Asn Lys Glu Ala Gly Ile Val Phe Lys Gly
675 680 685
Asp Phe Gly Asn Leu Glu Ala Ser Trp Phe Asn Asn Ala Tyr Arg Asp
690 695 700
Leu Ile Val Arg Gly Tyr Glu Ala Gln Ile Lys Asp Gly Lys Glu Gln
705 710 715 720
Val Lys Gly Asn Pro Ala Tyr Leu Asn Ala Gln Ser Ala Arg Ile Thr
725 730 735
Gly Ile Asn Ile Leu Gly Lys Ile Asp Trp Asn Gly Val Trp Asp Lys
740 745 750
Leu Pro Glu Gly Trp Tyr Ser Thr Phe Ala Tyr Asn Arg Val Arg Val
755 760 765
Arg Asp Ile Lys Lys Arg Ala Asp Arg Thr Asp Ile Gln Ser His Leu
770 775 780
Phe Asp Ala Ile Gln Pro Ser Arg Tyr Val Val Gly Ser Gly Tyr Asp
785 790 795 800
Gln Pro Glu Gly Lys Trp Gly Val Asn Gly Met Leu Thr Tyr Ser Lys
805 810 815
Ala Lys Glu Ile Thr Glu Leu Leu Gly Ser Arg Ala Leu Leu Asn Gly
820 825 830
Asn Ser Arg Asn Thr Lys Ala Thr Ala Arg Arg Thr Arg Pro Trp Tyr
835 840 845
Ile Val Asp Val Ser Gly Tyr Tyr Thr Val Lys Lys His Phe Thr Leu
850 855 860
Arg Ala Gly Val Tyr Asn Leu Leu Asn His Arg Tyr Val Thr Trp Glu
865 870 875 880

91

Asn Val Arg Gln Thr Ala Ala Gly Ala Val Asn Gln His Lys Asn Val
885 890 895
Gly Val Tyr Asn Arg Tyr Ala Ala Pro Gly Arg Asn Tyr Thr Phe Ser
900 905 910
Leu Glu Met Lys Phe
915

<210> 12
<211> 908
<212> PRT
<213> Pasteurella haemolytica

<400> 12
Met Gln Gln Gln His Leu Phe Arg Leu Asn Ile Leu Cys Leu Ser Leu
1 5 10 15
Met Thr Ala Leu Pro Val Tyr Ala Glu Asn Val Gln Ala Glu Gln Ala
20 25 30
Gln Glu Lys Gln Leu Asp Thr Ile Gln Val Lys Ala Lys Lys Gln Lys
35 40 45
Thr Arg Arg Asp Asn Glu Val Thr Gly Leu Gly Lys Leu Val Lys Ser
50 55 60
Ser Asp Thr Leu Ser Lys Glu Gln Val Leu Asn Ile Arg Asp Leu Thr
65 70 75 80
Arg Tyr Asp Pro Gly Ile Ala Val Val Glu Gln Gly Arg Gly Ala Ser
85 90 95
Ser Gly Tyr Ser Ile Arg Gly Met Asp Lys Asn Arg Val Ser Leu Thr
100 105 110
Val Asp Gly Val Ser Gln Ile Gln Ser Tyr Thr Ala Gln Ala Ala Leu
115 120 125
Gly Gly Thr Arg Thr Ala Gly Ser Ser Gly Ala Ile Asn Glu Ile Glu
130 135 140
Tyr Glu Asn Val Lys Ala Val Glu Ile Ser Lys Gly Ser Asn Ser Ser
145 150 155 160
Glu Tyr Gly Asn Gly Ala Leu Ala Gly Ser Val Ala Phe Gln Thr Lys
165 170 175
Thr Ala Ala Asp Ile Ile Gly Glu Gly Lys Gln Trp Gly Ile Gln Ser
180 185 190
Lys Thr Ala Tyr Ser Gly Lys Asp His Ala Leu Thr Gln Ser Leu Ala
195 200 205
Leu Ala Gly Arg Ser Gly Gly Ala Glu Ala Leu Leu Ile Tyr Thr Lys
210 215 220
Arg Arg Gly Arg Glu Ile His Ala His Lys Asp Ala Gly Lys Gly Val
225 230 235 240
Gln Ser Phe Asn Arg Leu Val Leu Asp Glu Asp Lys Lys Glu Gly Gly
245 250 255
Ser Gln Tyr Arg Tyr Phe Ile Val Glu Glu Glu Cys His Asn Gly Tyr
260 265 270
Ala Ala Cys Lys Asn Lys Leu Lys Glu Asp Ala Ser Val Lys Asp Glu
275 280 285
Arg Lys Thr Val Ser Thr Gln Asp Tyr Thr Gly Ser Asn Arg Leu Leu
290 295 300
Ala Asn Pro Leu Glu Tyr Gly Ser Gln Ser Trp Leu Phe Arg Pro Gly

95

	310										315										320	
Trp His Leu Asp Asn Arg His Tyr Val Gly Ala Val Leu Glu Arg Thr																						
325																					335	
Gln Gln Thr Phe Asp Thr Arg Asp Met Thr Val Pro Ala Tyr Phe Thr																						
340																					350	
Ser Glu Asp Tyr Val Pro Gly Ser Leu Lys Gly Leu Gly Lys Tyr Ser																						
355																					365	
Gly Asp Asn Lys Ala Glu Arg Leu Phe Val Gln Gly Glu Gly Ser Thr																						
370																					380	
Leu Gln Gly Ile Gly Tyr Gly Thr Gly Val Phe Tyr Asp Glu Arg His																						
385																					400	
Thr Lys Asn Arg Tyr Gly Val Glu Tyr Val Tyr His Asn Ala Asp Lys																						
405																					415	
Asp Thr Trp Ala Asp Tyr Ala Arg Leu Ser Tyr Asp Arg Gln Gly Ile																						
420																					430	
Asp Leu Asp Asn Arg Leu Gln Gln Thr His Cys Ser His Asp Gly Ser																						
435																					445	
Asp Lys Asn Cys Arg Pro Asp Gly Asn Lys Pro Tyr Ser Phe Tyr Lys																						
450																					460	
Ser Asp Arg Met Ile Tyr Glu Glu Ser Arg Asn Leu Phe Gln Ala Val																						
465																					480	
Phe Lys Lys Ala Phe Asp Thr Ala Lys Ile Arg His Asn Leu Ser Ile																						
485																					495	
Asn Leu Gly Tyr Asp Arg Phe Lys Ser Gln Leu Ser His Ser Asp Tyr																						
500																					510	
Tyr Leu Gln Asn Ala Val Gln Ala Tyr Asp Leu Ile Thr Pro Lys Lys																						
515																					525	
Pro Pro Phe Pro Asn Gly Ser Lys Asp Asn Pro Tyr Arg Val Ser Ile																						
530																					540	
Gly Lys Thr Thr Val Asn Thr Ser Pro Ile Cys Arg Phe Gly Asn Asn																						
545																					560	
Thr Tyr Thr Asp Cys Thr Pro Arg Asn Ile Gly Gly Asn Gly Tyr Tyr																						
565																					575	
Ala Ala Val Gln Asp Asn Val Arg Leu Gly Arg Trp Ala Asp Val Gly																						
580																					590	
Ala Gly Ile Arg Tyr Asp Tyr Arg Ser Thr His Ser Glu Asp Lys Ser																						
595																					605	
Val Ser Thr Gly Thr His Arg Asn Leu Ser Trp Asn Ala Gly Val Val																						
610																					620	
Leu Lys Pro Phe Thr Trp Met Asp Leu Thr Tyr Arg Ala Ser Thr Gly																						
625																					640	
Phe Arg Leu Pro Ser Phe Ala Glu Met Tyr Gly Trp Arg Ala Gly Glu																						
645																					655	
Ser Leu Lys Thr Leu Asp Leu Lys Pro Glu Lys Ser Phe Asn Arg Glu																						
660																					670	
Ala Gly Ile Val Phe Lys Gly Asp Phe Gly Asn Leu Glu Ala Ser Tyr																						
675																					685	
Phe Asn Asn Ala Tyr Arg Asp Leu Ile Ala Phe Gly Tyr Glu Thr Arg																						
690																					700	
Thr Gln Asn Gly Gln Thr Ser Ala Ser Gly Asp Pro Gly Tyr Arg Asn																						
705																					720	
Ala Gln Asn Ala Arg Ile Ala Gly Ile Asn Ile Leu Gly Lys Ile Asp																						
725																					735	

Trp His Gly Val Trp Gly Gly Leu Pro Asp Gly Leu Tyr Ser Thr Leu
740 745 750
Ala Tyr Asn Arg Ile Lys Val Lys Asp Ala Asp Ile Arg Ala Asp Arg
755 760 765
Thr Phe Val Thr Ser Tyr Leu Phe Asp Ala Val Gln Pro Ser Arg Tyr
770 775 780
Val Leu Gly Leu Gly Tyr Asp His Pro Asp Gly Ile Trp Gly Ile Asn
785 790 795 800
Thr Met Phe Thr Tyr Ser Lys Ala Lys Ser Val Asp Glu Leu Leu Gly
805 810 815
Ser Gln Ala Leu Leu Asn Gly Asn Ala Asn Ala Lys Lys Ala Ala Ser
820 825 830
Arg Arg Thr Arg Pro Trp Tyr Val Thr Asp Val Ser Gly Tyr Tyr Asn
835 840 845
Ile Lys Lys His Leu Thr Leu Arg Ala Gly Val Tyr Asn Leu Leu Asn
850 855 860
Tyr Arg Tyr Val Thr Trp Glu Asn Val Arg Gln Thr Ala Gly Gly Ala
865 870 875 880
Val Asn Gln His Lys Asn Val Gly Val Tyr Asn Arg Tyr Ala Ala Pro
885 890 895
Gly Arg Asn Tyr Thr Phe Ser Leu GI Met Lys Phe
900 905

<210> 13
<211> 604
<212> PRT
<213> Pasteurella haemolytica

<400> 13
Met Ile Met Lys Tyr His His Phe Arg Tyr Ser Thr Val Ala Leu Thr
1 5 10 15
Val Leu Phe Ala Leu Ser His Ser Tyr Gly Ala Ala Thr Glu Asn Lys
20 25 30
Lys Ile Glu Glu Asn Asn Asp Leu Ala Val Leu Asp Glu Val Ile Val
35 40 45
Thr Glu Ser His Tyr Ala His Glu Arg Gln Asn Glu Val Thr Gly Leu
50 55 60
Gly Lys Val Val Lys Asn Tyr His Glu Met Ser Lys Asn Gln Ile Leu
65 70 75 80
Gly Ile Arg Asp Leu Thr Arg Tyr Asp Pro Gly Ile Ser Val Val Glu
85 90 95
Gln Gly Arg Gly Ala Ser Ser Gly Tyr Ala Ile Arg Gly Val Asp Lys
100 105 110
Asn Arg Val Ser Leu Leu Val Asp Gly Leu Pro Gln Ala His Ser Tyr
115 120 125
His Thr Leu Ser Gly Asp Ala Asn Gly Gly Ala Ile Asn Glu Ile Glu
130 135 140
Tyr Glu Asn Ile Arg Ser Ile Glu Leu Ser Lys Gly Ala Ser Ser Ala
145 150 155 160
Glu Tyr Gly Ser Gly Ala His Gly Gly Ala Ile Gly Phe Arg Thr Lys
165 170 175
Asp Ala Gln Asp Ile Ile Lys Glu Gly Gln His Trp Gly Leu Asp Ser

97

180 185 190
Lys Thr Ser Tyr Ala Ser Lys Asn Ser His Phe Leu Gln Ile Ala Ala
195 200 205
Ala Gly Glu Ala Gly Gly Phe Glu Ala Leu Val Ile Ala Thr His Arg
210 215 220
His Gly Lys Glu Thr Lys Ile His Ser Glu Ala Asn Lys Leu Lys His
225 230 235 240
Asn Ile Arg Arg Ile Thr Gly Phe Glu Asn Arg Tyr Asp Phe Thr Gln
245 250 255
Ile Pro His Arg Met Pro Pro Gly Gly Ser Phe Phe Ile Val Glu Asp
260 265 270
Thr Cys Pro Thr Leu Asp Cys Thr Pro Arg Ala Arg Val Lys Leu Asn
275 280 285
Arg Asp Asn Phe Pro Val Arg Thr Phe Pro Glu Tyr Thr Pro Glu Glu
290 295 300
Arg Asn Ala Glu Gln Ile Pro Tyr Arg Thr Glu Gln Leu Ser Ala Gln
305 310 315 320
Glu Lys Thr Gly Lys Asp Arg Ile Ala Pro Asn Pro Leu Asp Tyr Lys
325 330 335
Ser Asn Ser Val Phe Met Lys Phe Gly Tyr His Phe Asn Ser Ser His
340 345 350
Tyr Leu Gly Ala Ile Leu Glu Asp Thr Lys Gln Arg Thr Ile Ser Val
355 360 365
Ile Cys Lys Arg Gln Leu Thr Ile Gln Lys Thr Ile Leu Thr Tyr His
370 375 380
Leu Gly Thr Met Phe Met Lys Gly Ile Ile Phe Arg Trp Leu Ser Val
385 390 395 400
Gln Ala Lys Asp Pro Leu Trp Val Ala His Met Pro Cys Glu Val Asp
405 410 415
Glu Arg His His Lys Arg Arg Leu Gly Phe Thr Tyr Lys Tyr Lys Pro
420 425 430
Glu Asn Asn Arg Trp Leu Asp Ser Ile Asn Ser Cys Val Arg Ala Leu
435 440 445
Arg Ser Arg Cys Cys Ala Leu Ser Lys Gln Asp Ile Glu Leu Tyr Ser
450 455 460
Arg Leu His Arg Leu His Cys Ser Asp Tyr Pro Val Val Asp Lys Asn
465 470 475 480
Cys Gly Pro Thr Leu Asp Lys Ser Trp Ser Met Tyr Arg Thr Glu Arg
485 490 495
Asn Asn Tyr Gln Glu Lys Ala Thr Cys His Ser Phe Cys Ile Leu Lys
500 505 510
Ala Leu Asn Ala Gly Gln Gly Val Phe Lys Gln Thr His Lys Leu Asn
515 520 525
Leu Gly Leu Gly Phe Glu Ser Asn Leu Ile Arg Leu Thr Ile Ile Gly
530 535 540
Ile Ile Leu Pro Asn Ile Pro Lys Ala Gly Tyr Thr Ser Tyr Arg Gly
545 550 555 560
Arg Gly Arg Leu Asp Asn Pro Tyr Ile Tyr Arg Arg Asp Pro Arg Ser
565 570 575
Ile Glu Thr Val Ser Leu Cys Asn Asn Thr Arg Ala Thr Leu Leu Leu
580 585 590
Leu Arg Val Asn Lys Gly Ile Arg Leu Leu Leu Arg
595 600

98

<210> 14
<211> 593
<212> PRT
<213> Pasteurella haemolytica

<400> 14
Met His Phe Lys Leu Asn Pro Tyr Ala Leu Ala Phe Thr Ser Leu Phe
1 5 10 15
Leu Val Ala Cys Ser Gly Gly Lys Gly Ser Phe Asp Leu Glu Asp Val
20 25 30
Arg Pro Asn Gln Thr Ala Lys Ala Glu Lys Ala Thr Thr Ser Tyr Gln
35 40 45
Asp Glu Glu Thr Lys Lys Thr Lys Glu Glu Leu Asp Lys Leu Met
50 55 60
Glu Pro Ala Leu Gly Tyr Glu Thr Gln Ile Leu Arg Arg Asn Lys Ala
65 70 75 80
Pro Lys Thr Glu Thr Gly Glu Lys Arg Asn Glu Arg Val Val Glu Leu
85 90 95
Ser Glu Asp Lys Ile Thr Lys Leu Tyr Gln Glu Ser Val Glu Ile Ile
100 105 110
Pro His Leu Asp Glu Leu Asp Gly Lys Thr Thr Ser Asn Asp Val Tyr
115 120 125
His Ser His Asp Ser Lys Arg Leu Asp Lys Asn Arg Asp Leu Lys Tyr
130 135 140
Val Arg Ser Gly Tyr Val Tyr Asp Gly Ser Phe Asn Glu Ile Arg Arg
145 150 155 160
Asn Asp Ser Gly Phe His Val Phe Lys Gln Gly Ile Asp Gly Tyr Val
165 170 175
Tyr Tyr Leu Gly Val Thr Pro Ser Lys Glu Leu Pro Lys Gly Lys Val
180 185 190
Ile Ser Tyr Lys Gly Thr Trp Asp Phe Val Ser Asn Ile Asn Leu Glu
195 200 205
Arg Glu Ile Asp Gly Phe Asp Thr Ser Gly Asp Gly Lys Asn Val Ser
210 215 220
Ala Thr Ser Ile Thr Glu Thr Val Asn Arg Asp His Lys Val Gly Glu
225 230 235 240
Lys Leu Gly Asp Asn Glu Val Lys Gly Val Ala His Ser Ser Glu Phe
245 250 255
Ala Val Asp Phe Asp Asn Lys Lys Leu Thr Gly Ser Leu Tyr Arg Asn
260 265 270
Gly Tyr Ile Asn Arg Asn Lys Ala Gln Glu Val Thr Lys Arg Tyr Ser
275 280 285
Ile Glu Ala Asp Ile Ala Gly Asn Arg Phe Arg Gly Lys Ala Lys Ala
290 295 300
Glu Lys Ala Gly Asp Pro Ile Phe Thr Asp Ser Asn Tyr Leu Glu Gly
305 310 315 320
Gly Phe Tyr Gly Pro Lys Ala Glu Glu Met Ala Gly Lys Phe Phe Thr
325 330 335
Asn Asn Lys Ser Leu Phe Ala Val Phe Ala Ala Lys Ser Glu Asn Gly
340 345 350
Glu Thr Thr Thr Glu Arg Ile Ile Asp Ala Thr Lys Ile Asp Leu Thr

99

355 360 365
Gln Phe Asn Ala Lys Glu Leu Asn Asn Phe Gly Asp Ala Ser Val Leu
370 375 380
Ile Ile Asp Gly Gln Lys Ile Asp Leu Ala Gly Val Asn Phe Lys Asn
385 390 395 400
Ser Lys Thr Val Glu Ile Asn Gly Lys Thr Met Val Ala Val Ala Cys
405 410 415
Cys Ser Asn Leu Glu Tyr Met Lys Phe Gly Gln Leu Trp Gln Lys Glu
420 425 430
Gly Lys Gln Gln Val Lys Asp Asn Ser Leu Phe Leu Gln Gly Glu Arg
435 440 445
Thr Ala Thr Asp Lys Met Pro Ala Gly Gly Asn Tyr Lys Tyr Val Gly
450 455 460
Thr Trp Asp Ala Leu Val Ser Lys Gly Thr Asn Trp Ile Ala Glu Ala
465 470 475 480
Asp Asn Asn Arg Glu Ser Gly Tyr Arg Thr Glu Phe Asp Val Asn Phe
485 490 495
Ser Asp Lys Lys Val Asn Gly Lys Leu Phe Asp Lys Gly Gly Val Asn
500 505 510
Pro Val Phe Thr Val Asp Ala Thr Ile Asn Gly Asn Gly Phe Ile Gly
515 520 525
Ser Ala Lys Thr Ser Asp Ser Gly Phe Ala Leu Asp Ala Gly Ser Ser
530 535 540
Gln His Gly Asn Ala Val Phe Ser Asp Ile Lys Val Asn Gly Gly Phe
545 550 555 560
Tyr Gly Pro Thr Ala Gly Glu Leu Gly Gly Gln Phe His His Lys Ser
565 570 575
Asp Asn Gly Ser Val Gly Ala Val Phe Gly Ala Lys Arg Gln Ile Glu
580 585 590
Lys

<210> 15
<211> 547
<212> PRT
<213> Pasteurella haemolytica

<400> 15
Met His Phe Lys Leu Asn Pro Tyr Ala Leu Ala Phe Thr Ser Leu Phe
1 5 10 15
Leu Val Ala Cys Ser Gly Gly Lys Gly Ser Phe Asp Leu Glu Asp Val
20 25 30
Arg Pro Asn Lys Thr Thr Gly Val Ser Lys Glu Glu Tyr Lys Asp Val
35 40 45
Glu Thr Ala Lys Lys Glu Lys Glu Gln Leu Gly Glu Leu Met Glu Pro
50 55 60
Ala Leu Gly Tyr Val Val Lys Val Pro Val Ser Ser Phe Glu Asn Lys
65 70 75 80
Lys Val Asp Ile Ser Asp Ile Glu Val Ile Thr Asn Gly Asn Leu Asp
85 90 95
Asp Val Pro Tyr Lys Ala Asn Ser Ser Lys Tyr Asn Tyr Pro Asp Ile
100 105 110

100

Lys Thr Lys Asp Ser Ser Leu Gln Tyr Val Arg Ser Gly Tyr Val Ile
115 120 125
Asp Gly Glu His Ser Gly Ser Asn Glu Lys Gly Tyr Val Tyr Tyr Lys
130 135 140
Gly Asn Ser Pro Ala Lys Glu Leu Pro Val Asn Gln Leu Leu Thr Tyr
145 150 155 160
Thr Gly Ser Trp Asp Phe Thr Ser Asn Ala Asn Leu Asn Asn Glu Glu
165 170 175
Gly Arg Pro Asn Tyr Leu Asn Asp Asp Tyr Tyr Thr Lys Phe Ile Gly
180 185 190
Lys Arg Val Gly Leu Val Ser Gly Asp Ala Lys Pro Ala Lys His Lys
195 200 205
Tyr Thr Ser Gln Phe Glu Val Asp Phe Ala Thr Lys Lys Met Thr Gly
210 215 220
Lys Leu Ser Asp Lys Glu Lys Thr Ile Tyr Thr Val Asn Ala Asp Ile
225 230 235 240
Arg Gly Asn Arg Phe Thr Gly Ala Ala Thr Ala Ser Asp Lys Asn Lys
245 250 255
Gly Lys Gly Glu Ser Tyr Asn Phe Phe Ser Ala Asp Ser Gln Ser Leu
260 265 270
Glu Gly Gly Phe Tyr Gly Pro Lys Ala Glu Glu Met Ala Gly Lys Phe
275 280 285
Val Ala Asn Asp Lys Ser Leu Phe Ala Val Phe Ser Ala Lys His Asn
290 295 300
Gly Ser Asn Val Asn Thr Val Arg Ile Ile Asp Ala Ser Lys Ile Asp
305 310 315 320
Leu Thr Asn Phe Ser Ile Ser Glu Leu Asn Asn Phe Gly Asp Ala Ser
325 330 335
Val Leu Ile Ile Asp Gly Lys Lys Ile Lys Leu Ala Gly Ser Gly Phe
340 345 350
Thr Asn Lys His Thr Ile Glu Ile Asn Gly Lys Thr Met Val Ala Val
355 360 365
Ala Cys Cys Ser Asn Leu Glu Tyr Met Lys Phe Gly Gln Leu Trp Gln
370 375 380
Gln Ala Glu Gly Gly Lys Pro Glu Asn Asn Ser Leu Phe Leu Gln Gly
385 390 395 400
Glu Arg Thr Ala Thr Asp Lys Met Pro Lys Gly Gly Asn Tyr Lys Tyr
405 410 415
Ile Gly Thr Trp Asp Ala Gln Val Ser Lys Glu Asn Asn Trp Val Ala
420 425 430
Thr Ala Asp Asp Asp Arg Lys Ala Gly Tyr Arg Thr Glu Phe Asp Val
435 440 445
Asp Phe Gly Asn Lys Asn Leu Ser Gly Lys Leu Phe Asp Lys Asn Gly
450 455 460
Val Asn Pro Val Phe Thr Val Asp Ala Lys Ile Asp Gly Asn Gly Phe
465 470 475 480
Thr Gly Lys Ala Lys Thr Ser Asp Glu Gly Phe Ala Leu Asp Ser Gly
485 490 495
Ser Ser Arg Tyr Glu Asn Val Lys Phe Asn Asp Val Ala Val Ser Gly
500 505 510
Gly Phe Tyr Gly Pro Thr Ala Ala Glu Leu Gly Gly Gln Phe His His
515 520 525
Lys Ser Glu Asn Gly Ser Val Gly Ala Val Phe Gly Ala Lys Gln Gln

(D)

530
Val Lys Lys
545

535

540

<210> 16
<211> 64
<212> PRT
<213> Pasteurella haemolytica

<400> 16
Asp Glu Val Ile Val Thr Glu Tyr Ala Ile Arg Gly Val Asp Lys Asn
1 5 10 15
Arg Val Ser Leu Leu Val Asp Gly Ile Glu Leu Ser Lys Gly Ala Ser
20 25 30
Ser Ala Glu Tyr Gly Ser Gly Ala His Gly Gly Ala Ile Gly Phe Arg
35 40 45
Thr Lys Asp Phe Lys Gln Thr His Lys Leu Asn Leu Gly Leu Gly Phe
50 55 60

<210> 17
<211> 64
<212> PRT
<213> Pasteurella haemolytica

<400> 17
Glu Thr Met Val Val Thr Ala Val Ser Ile Arg Gly Leu Asp Ser Ser
1 5 10 15
Tyr Thr Leu Ile Leu Val Asp Gly Ile Glu Val Val Arg Gly Pro Met
20 25 30
Ser Ser Leu Tyr Gly Ser Asp Ala Leu Gly Gly Val Val Asn Ile Ile
35 40 45
Thr Lys Lys Pro Glu Thr Ser Glu Ser Trp Glu Leu Gly Leu Tyr Tyr
50 55 60

<210> 18
<211> 64
<212> PRT
<213> Pasteurella haemolytica

<400> 18
Asp Thr Ile Val Val Thr Ala Ile Asp Ile Arg Gly Met Gly Pro Glu
1 5 10 15
Asn Thr Leu Ile Leu Ile Asp Gly Ile Glu Val Leu Arg Gly Pro Ala
20 25 30
Arg Ala Arg Tyr Gly Asn Gly Ala Ala Gly Gly Val Val Asn Ile Ile
35 40 45
Thr Lys Lys Ala Glu Thr Ser Ile Asn Lys Glu Ile Gly Leu Glu Phe
50 55 60

<210> 19
<211> 64
<212> PRT
<213> Pasteurella haemolytica

<400> 19
Asp Thr Ile Thr Val Thr Ala Leu Ile Ile Arg Gly Phe Ala Ala Glu
1 5 10 15
Gly Gln Asn Asn Tyr Leu Asn Gly Ala Glu Ile Met Arg Gly Pro Val
20 25 30
Ser Val Leu Tyr Gly Lys Ser Ser Pro Gly Gly Leu Leu Asn Met Val
35 40 45
Ser Lys Arg Pro Ser Lys Gly Lys Gln Tyr Glu Val Gly Val Lys Tyr
50 55 60

<210> 20
<211> 67
<212> PRT
<213> Pasteurella haemolytica

<400> 20
Phe Thr Leu Ser Val Asp Ala Phe Gly Ile Arg Gly Leu Asn Pro Arg
1 5 10 15
Leu Thr Ser Arg Ser Thr Val Leu Met Asp Gly Ile Asp Val Val Arg
20 25 30
Gly Gly Gly Ala Val Arg Tyr Gly Pro Gln Ser Val Gly Gly Val Val
35 40 45
Asn Phe Val Thr Arg Ala Pro Glu Lys Ala Arg Thr Trp Glu Leu Gly
50 55 60
Thr Arg Tyr
65

<210> 21
<211> 330
<212> DNA
<213> Pasteurella haemolytica

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